

REMARKS

Applicants respectfully request the USPTO to reconsider and allow the present application. The foregoing amendments are responsive to the action mailed September 4, 2002. Applicants respectfully request reconsideration of the application in view of the following comments.

Amendment to the Title

The title has been amended herein to better describe the invention. Applicant respectfully requests entry and approval of the new title.

Amendment to the Specification

The disclosure is objected to as allegedly being unclear. The final action states that the recitation of an interlayer insulating film 103 on page 5, lines 2-3, of being a silicide film is unclear. The action questions how an insulating film can be a conducting film. For improved clarity, the specification has been amended to clarify this, and to include examples of insulating films. These insulating films were previously disclosed on page 4, lines 24-27, and do not constitute new matter. The applicants request the allowance of this amendment to the disclosure.

Response to objections under 35 U.S.C. 103(a)

Claims 1-2, 4-6, 8-9, 11-12, 14-15, 19-21, 23-25, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art (APA) in view of Kim (5,846,877). The rejected independent claims are 1, 5, 9, 12, 15, 20, and 24.

The final action asserts that the "APA does not teach an alloy comprising at least one selected from the group consisting of germanium, tin, gallium, zinc, indium, and antimony existing

at least in the contact hole and at a boundary between the conductive layer and the wiring and/or a vicinity thereof." The final action also states that "Kim teaches in figure 3D and related text a wiring electrode 110 in a contact hole comprising an aluminum layer 108 formed over an alloy 106 comprising at least one selected from the group consisting of germanium, tin, gallium, zinc, indium, and antimony (column 3, lines 50-64) such that the electrode is flowable at 450 degrees C or less." The final action contends that it would have been obvious to a person of ordinary skill in the art to use the wiring structure, as taught by Kim, such that an "alloy comprising at least one selected from the group consisting of germanium, tin, gallium, zinc, indium, and antimony exists at least in the contact hole and at a boundary between the conductive layer and the wiring and/or a vicinity thereof in APA's device in order to improve the electromigration and the contact resistance between the wiring and the conductive layer."

However, the materials of tin, gallium, zinc, indium, and antimony are neither taught by Kim in the aforementioned text (col. 3, lines 50-64), nor anywhere else in Kim's disclosure. Therefore, it would not be obvious to use these materials. Moreover, the rejected independent claims 1, 5, 9, 12, 15, 20, and 24 have been amended to omit the element Ge to further emphasize the patentability. Therefore, the applicants believe that the independent claim rejections of claims 1, 5, 9, 12, 15, 20, and 24 are not appropriate and the pending claims should be in condition for allowance.

Claims 23 and 27 depend upon the independent Claims 20 and 24, respectfully. The APA fails to teach an alloy comprising at least one selected from the group consisting of Sn, Ga, Zn, Pb, In, and Sb existing at least in the contact hole and at a boundary between the semiconductor region and the wiring and/or

vicinity thereof as recited in Claims 20 and 24. Since Claims 20 and 24 are allowable, then their dependent claims should also be placed in condition for allowance. Therefore, applicants respectfully request allowance of dependent Claims 23 and 27.

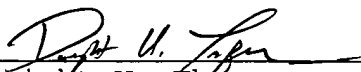
Claims 2, 4, 6, 8, 11, 14, 19, 21, and 25 depend either directly or indirectly from one of the independent claims. Each dependent claim further defines the independent claim from which it depends.

In view of the foregoing remarks regarding Claims 1, 5, 9, 12, 15, 20, and 24, applicants respectfully submit that Claims 2, 4, 6, 8, 11, 14, 19, 21, and 25 are likewise in condition for allowance. Applicants respectfully request allowance of dependent Claims 2, 4, 6, 8, 11, 14, 19, 21, and 25.

Attached is a marked-up version of the changes being made by the current amendment. Applicant asks that all claims be allowed. Please apply any other charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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Version with markings to show changes made

In the title:

Please amend the title:

[SEMICONDUCTOR DEVICE AND ITS MANUFACTURING METHOD]
SEMICONDUCTOR DEVICE HAVING A RELIABLE CONTACT

In the specification:

Paragraph beginning at page 5, lines 2-3 has been amended as follows:

To complete the contact hole 104, it is necessary to etch the interlayer insulating film 103 which [is a silicide film] may be a silicon oxide film, a silicon nitride film, a silicon oxynitride film, or the like, and then etch the anodic oxide film 102.

In the claims:

Claim 1, 5, 9, 12, 15, 20, and 24 has been amended as follows:

1. (Amended) A semiconductor device comprising at least one thin film transistor over a substrate, said thin film transistor comprising:

a conductive layer comprising aluminum;
an insulating film formed on said conductive layer;
a contact hole formed through said insulating film;
a wiring electrically connected with said conductive layer in said contact hole; and

an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at least in said contact hole and at a boundary between said conductive layer and said wiring and a vicinity thereof.

5. (Amended) A semiconductor device comprising at least one thin film transistor over a substrate, said thin film transistor comprising:

- a conductive layer comprising aluminum;
- an insulating film formed on said conductive layer;
- a contact hole formed through said insulating film;
- a wiring electrically connected with said conductive layer in said contact hole; and

- an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at least in said contact hole and at a boundary between said conductive layer and said wiring or a vicinity thereof.

9. (Amended) A semiconductor device comprising at least one thin film transistor over a substrate, said thin film transistor comprising:

- two conductive films comprising aluminum electrically connected with each other in a contact hole opened in an insulating film; and

- an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at least in said contact hole and at a boundary between said two conductive films and a vicinity thereof.

12. (Amended) A semiconductor device comprising at least one thin film transistor over a substrate, said thin film transistor comprising:

- two conductive films comprising aluminum electrically connected with each other in a contact hole opened in an insulating film; and

an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at least in said contact hole and at a boundary between said two conductive films or a vicinity thereof.

15.(Amended) A semiconductor device comprising at least one thin film transistor over a substrate, said thin film transistor comprising:

a wiring electrode comprising aluminum which is electrically connected to at least a part of said semiconductor device through a contact hole formed through an interlayer insulating film; and

an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb contained in the wiring electrode and existing at least in said contact hole and at a boundary between said wiring electrode and the part of said semiconductor device which one renders the wiring electrode flowable at 450 °C or less.

20.(Amended) A semiconductor device comprising:

at least one thin film transistor formed over a substrate, said thin film transistor comprising at least a semiconductor region, a gate electrode, and a gate insulating film interposed therebetween;

an interlayer insulating film formed over said thin film transistor;

a contact hole formed through said interlayer insulating film;

a wiring electrically connected with said semiconductor region in said contact hole; and

an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at

least in said contact hole and at a boundary between said semiconductor region and said wiring and a vicinity thereof.

24. (Amended) A semiconductor device comprising:

at least one thin film transistor formed over a substrate, said thin film transistor comprising at least a semiconductor region, a gate electrode, and a gate insulating film interposed therebetween;

an interlayer insulating film formed over said thin film transistor;

a contact hole formed through said interlayer insulating film;

a wiring electrically connected with said semiconductor region in said contact hole; and

an alloy comprising at least one selected from the group consisting of [Ge,] Sn, Ga, Zn, Pb, In, and Sb existing at least in said contact hole and at a boundary between said semiconductor region and said wiring or a vicinity thereof.